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ABSTRACT

This is a School Mathematics Study Group (SMSG) probability text for primary school students. The main goal of the text is to introduce some basic ideas of probability. The text is written at the level of a child's intuitive knowledge of what constitutes "an equal chance" or "a better chance." The authors suggest that there are certain fringe benefits to be derived from the unit: (1) it shows children that mathematics can be fun; (2) it promotes systematic thinking; (3) arithmetical skills may be practiced and reinforced; and (4) it provides opportunities for independent investigations. Chapter topics include: (1) certainty and uncertainty; (2) comparing the likelihood of various events; (3) combining events - this one and that one; (4) combining events - this one or that one; (5) number of possibilities; (6) combinations of two things; (7) combinations of three things or four things; (8) ordered arrangements; (9) arrangements and probability; and (10) repeated trials. (MP)

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PROBABILITY FOR PRIMARY GRADES

Student Text

(Revised Edition)

SE 025 223

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PROBABILITY UNIT - PRIMARY GRADES

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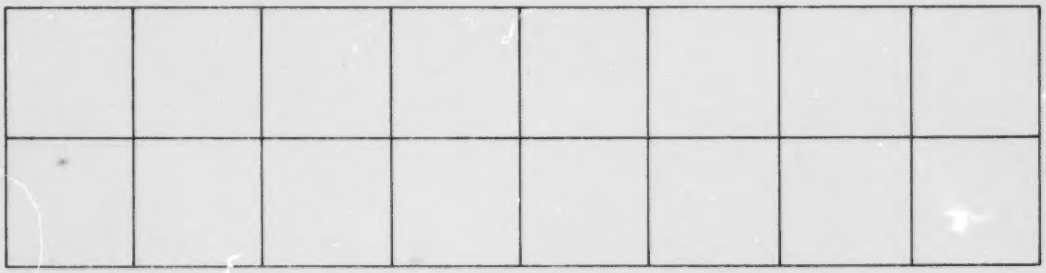
Shake your checker in a cup or spin it and let it stop. If the ☆ shows, put an S in one of the boxes under ☆ . If the ♔ shows, put a C in a box under the ♔ . Stop when one set of boxes is filled.

☆



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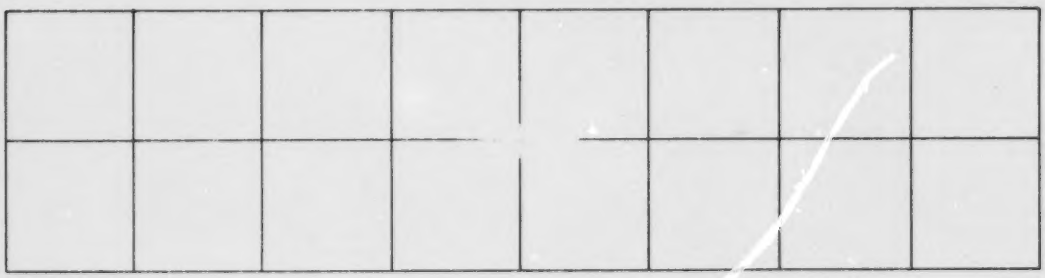


1. How many C's did you make? _____
2. How many S's did you make? _____
3. How many times did you spin or toss the checker? _____
4. How many more marks are there in one set of boxes than in the other? _____
5. Which do you think another toss or spin will show, a ☆ or a ♔ ? _____
6. Toss or spin again. Did you guess right? _____

Now let's try again. Shake your checker in a cup or spin it and let it stop. If the ☆ shows, put an S in one of the boxes under ☆ If the shows, put a C in a box under the . Stop when one set of boxes is filled.

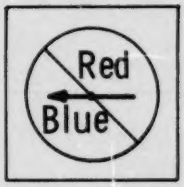
☆

1. Did you get the same results as last time? _____
2. How many times did you spin or toss the checker? _____
3. How many S's did you make? _____
4. How many C's did you make? _____
5. How many more marks are there in one set of boxes than in the other? _____
6. Which do you think another toss or spin will show, a ☆ or a ? _____
7. Toss or spin again. Did you guess right? _____
8. Can you be <u>certain</u> which side of the checker will be up? _____

Shake your checker in a cup or spin it and let it stop. Show in the boxes which side comes up. If the side with the ☆ comes up, put an S in a box. If the comes up, put a C in a box. Stop when all boxes are filled.

1. How many ☆'s did you see? _____
2. How many 's did you see? _____
3. How many times did you spin or toss the checker? _____
4. What is the difference between the number of S's and C's ? _____
5. Guess what will come up next time you spin or toss. _____
6. Spin or toss again. Did you guess right? _____
7. Each time you do this, is it <u>uncertain</u> which side will come up? _____

A Race

Use the spinner 

Keep it flat on the desk.

You and another pupil race.

First color the race track red or blue as shown.

One pupil chooses the red track, the other the blue track.

Each pupil put a marker on start.

If the spinner stops on red, the pupil with the red track moves one space.

If the spinner stops on blue, the pupil with the blue track moves one space.

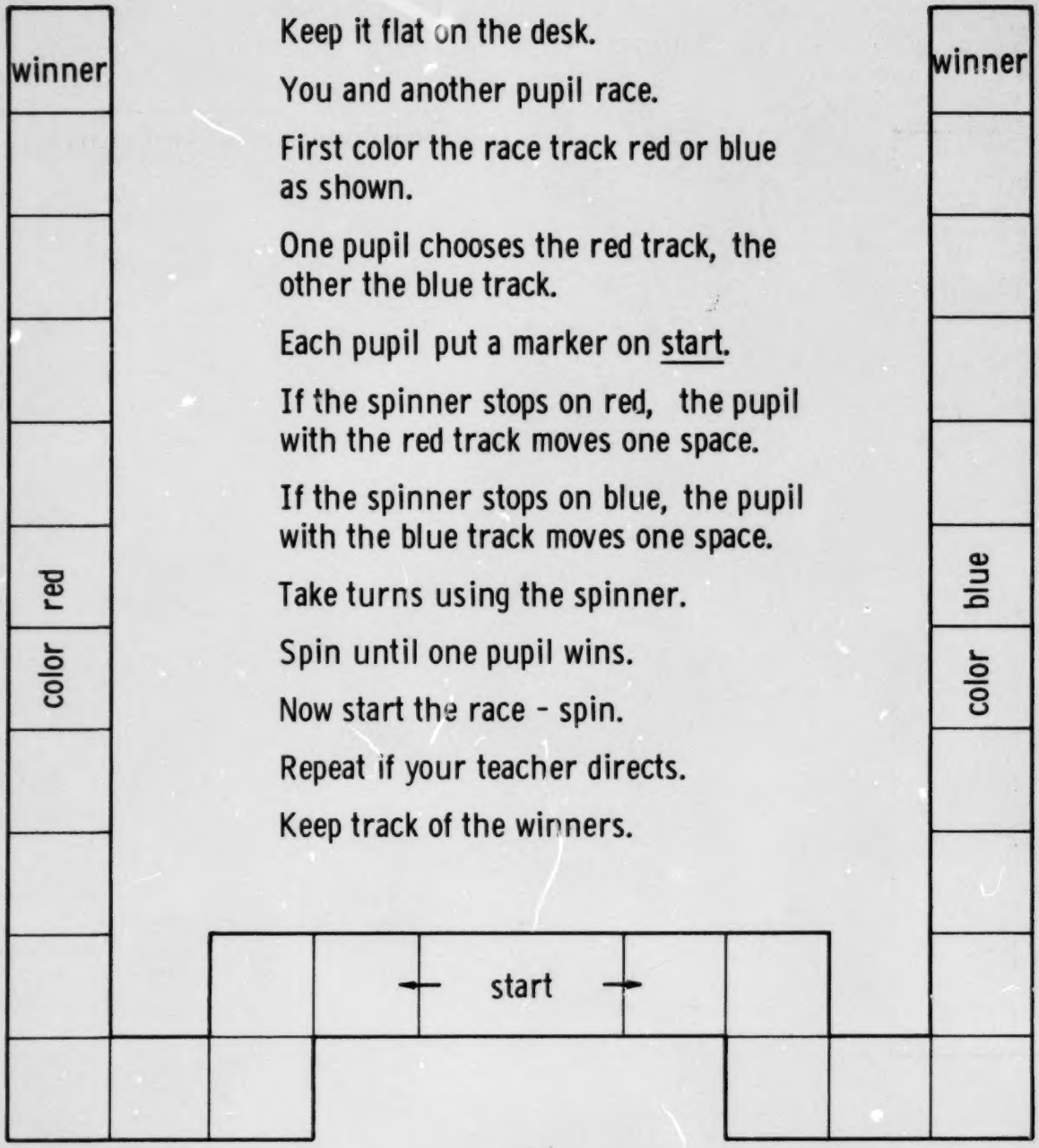
Take turns using the spinner.

Spin until one pupil wins.

Now start the race - spin.

Repeat if your teacher directs.

Keep track of the winners.

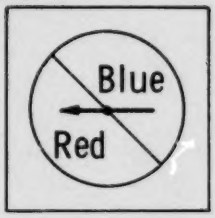


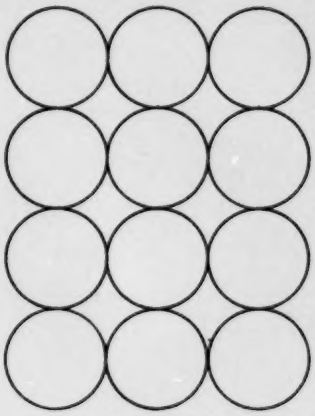
Take a Walk

Color the sidewalk as shown.

Do not color the space marked "Home".

Use the spinner:



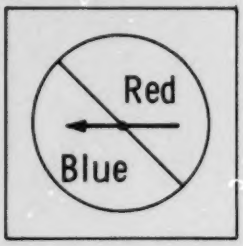


Put your marker on Home. If the spinner stops on red, move down one space. If it stops on blue, move up one space. Put an X in one of the circles each time you spin. When you fill the circles, put an X in the space where your marker is. If you get to the top or the bottom, do not spin again. Put an X in the space where your marker is.

1. How far from Home is your marker? _____
2. Where is it - on red, on blue, or back Home ? _____
3. How many pupils in your room are on blue? _____
4. According to the rules, how far from Home could you get? _____

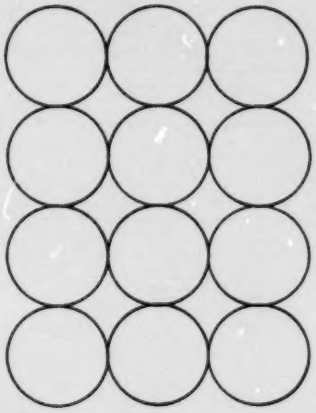
A Choice

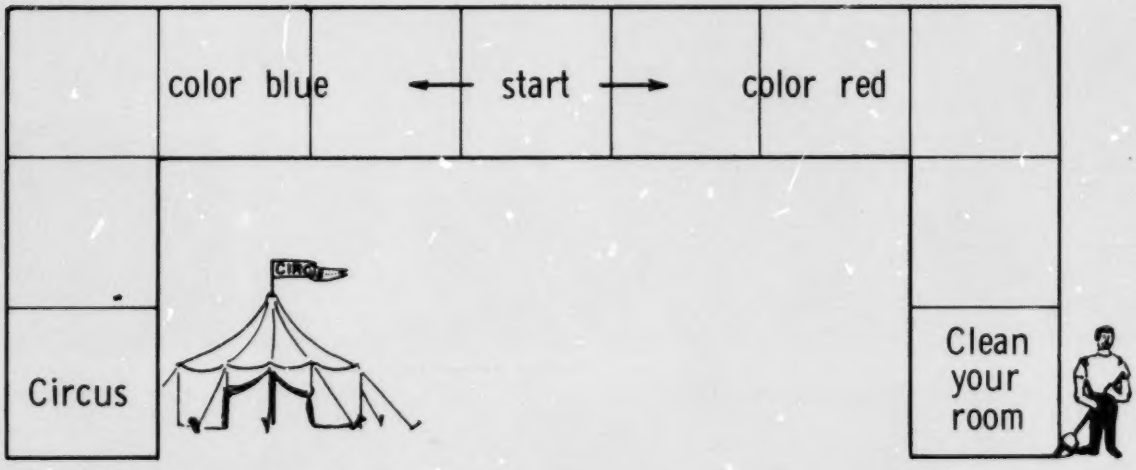
Use the spinner



Your mother gives you a choice of going to the circus or cleaning your room.
Color the choice as shown.
Put your marker on start. If the spinner stops on red, move one space toward "Clean your room".

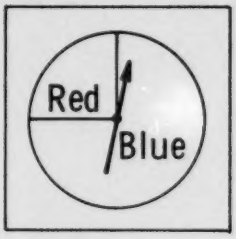
If the spinner stops on blue, move one space toward "Circus".
Put an X in one of the circles here each time you spin.
If you get to "Circus" or "Clean your room", stop.
If you fill in all of the circles, stop and mark with an X where your marker is.
Spin.

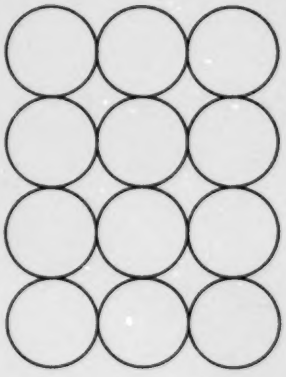




Another Walk

Use the spinner:





Color the sidewalk as shown. Do not color the space marked "Home".

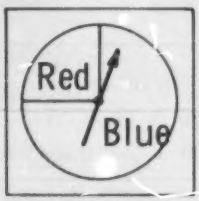
Put your marker on Home. Spin. If the spinner stops on red, move down one space. If it stops on blue, move up one space.

Put an X in one of the circles each time you spin. When you fill the circles, put an X in the space where your marker is. If you get to the top or the bottom, do not spin again. Put an X in the space where your marker is.

1. Where did you end - on red, on blue, or back Home? _____
2. How many pupils in your room did not get to either end? _____
3. How many pupils stopped on red? _____
4. Do you think more pupils should have stopped on red than on blue? _____

Another Choice

Use the spinner



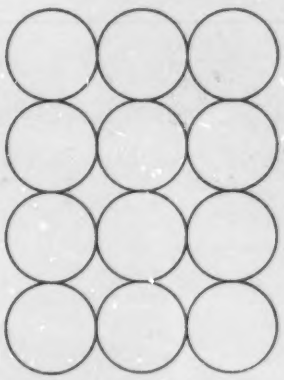
Your mother gives you another choice. If the spinner stops on red, move toward "Clean your room". If the spinner stops on blue, move toward "Circus".

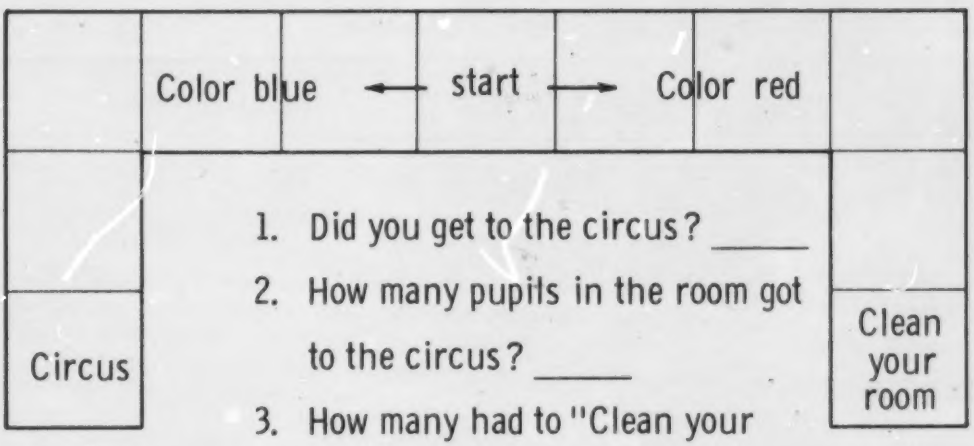
Put an X in one of the circles here each time you spin.

If you get to "Circus" or "Clean your room", stop.

If you fill in all of the circles, stop and mark with an X where your marker is.

Spin.

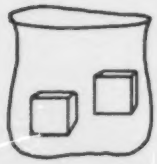




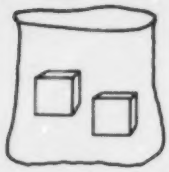
1. Did you get to the circus? _____
2. How many pupils in the room got to the circus? _____
3. How many had to "Clean your room"? _____
4. How many pupils in the room did not get to either end? _____

Color the blocks in the bags blue. Tell how many red blocks you would put in each bag:

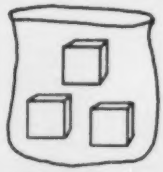
1. If I wanted to have an equal chance of drawing red or blue, I would put in _____ red blocks.



2. If I wanted blue to be more likely than red, I could put in _____ red blocks.

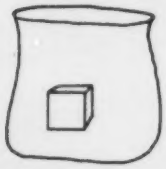


3. If I wanted blue to be less likely than red, I could put in _____ red blocks.

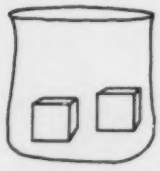


4. If I wanted an equal chance of drawing red or blue, I would put in _____ red blocks.

5. If I wanted to be sure I would draw a red every time, I could put in _____.

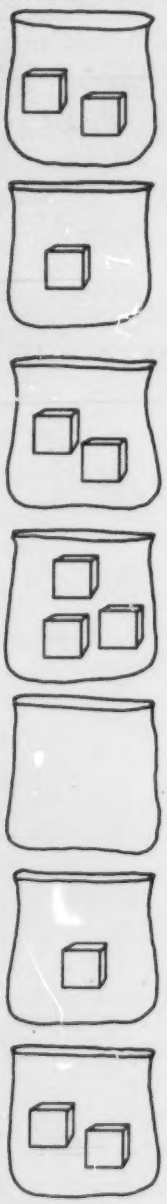


6. If I wanted to be sure of drawing a blue block, I would put in _____ red blocks.



7. If I wanted to be sure of drawing a blue block, I would put in _____ red blocks.

Color the blocks in the bags blue. Tell how many red blocks you would put in each bag:

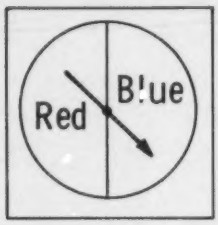


1. If I wanted to draw a red block about as often as a blue one, I would put in _____.
2. If I wanted to draw a red block 3 times as often as a blue one, I would put in _____.
3. If I wanted to draw a red block half as often as a blue one, I would put in _____.
4. If I wanted to draw a blue block every time, I would put in _____.
5. If I wanted to draw a red block every time, I could put in _____.
6. If I wanted to draw a red block twice as often as a blue one, I would put in _____.
7. If I wanted to draw a red block one third of the time, I would put in _____.

Brain Teaser: I have a bag with 3 red blocks in it. If I wanted to draw a blue block $\frac{2}{3}$ of the time, I would put in _____ blue blocks.

Spin and Draw

Use the spinner:



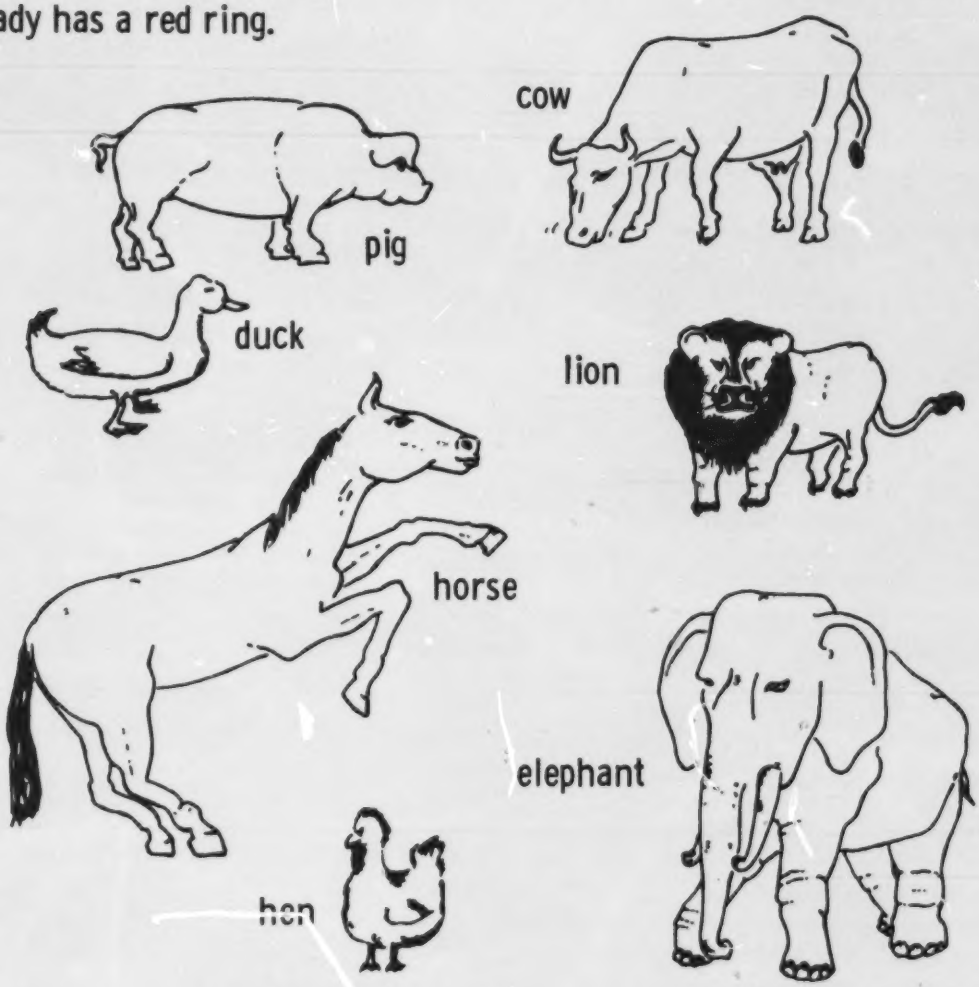
Put a red block and a blue block in a bag. Have two teams. One player for Team A spins. Then another player for Team A withdraws a block from the bag.

To score, the spinner must stop on red and a red block must be withdrawn. Now Team B spins and draws. Play until each team has 20 turns. Teams take turns. Keep score in the box by using tally marks.

Team A	Team B

1. What is Team A's score after 20 turns? _____
2. What is Team B's score after 20 turns? _____
3. Are you just as likely to get red as blue when you spin? _____
4. Are you just as likely to draw a red block as a blue block? _____
5. Does the spin have any effect on the block that is chosen? _____
6. Which is more likely? (Draw a ring around the number.)
   (1) to get red both times.
   (2) to get red just once.

Draw a red ring around the name of every animal that has four legs. Draw a blue ring around the name of every farm animal, even if it already has a red ring.



1. I drew _____ red rings. There are _____ animals with four legs.
2. I drew _____ blue rings. There are _____ farm animals.
3. _____ words have both a red and a blue ring around them. There are _____ animals which are <u>both</u> farm animals <u>and</u> have four legs.
4. Are all animals which have four legs farm animals? _____
5. Do you think there are more animals which have four legs than there are animals which <u>both</u> have four legs <u>and</u> are farm animals? _____

Look at these words. Draw a red ring around every word that has the letter a in it. Draw a blue ring around every word that has the letter n in it, even if it already has a red ring.

about	begin	cat	do	each
father	hand	him	always	banana
look	make	my	penny	one
ran	we	where	work	you

1. _____ words have the letter a in them.
2. _____ words have the letter n in them.
3. _____ words have both the letter a and the letter n in them.
4. Which are there more of -- words with red rings, or words with both red and blue rings? _____ rings.
5. Would you expect to have more words with both a and n than just with a ? _____
6. In the Wicks family there are four children.
   Guess which is more likely:
   (1) Each child's name has an r in it.
   (2) Each child's name has both an r and an a in it.
   Here are the actual names of the children:
   Richard Frank Dorothy Mary
   Look carefully at each name. Did you guess correctly? _____

Score Card

This page is for you to keep score of some games played by your class.
Your teacher will lead the games.

I

Two green blocks and one yellow block in a bag. One draw.

Team A	Team B

Make tally marks

Winner is _____.

II

Two green blocks and one yellow block in a bag. Two draws allowed.

Team A	Team B

Make tally marks

Winner is _____.

III

Spinner and blocks.

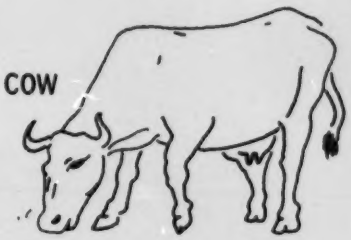
Team A	Team B

Make tally marks

Winner is _____.

These are the names of animals. Draw a red ring around the name of every animal that has four legs. Draw a blue ring around the name of every farm animal.

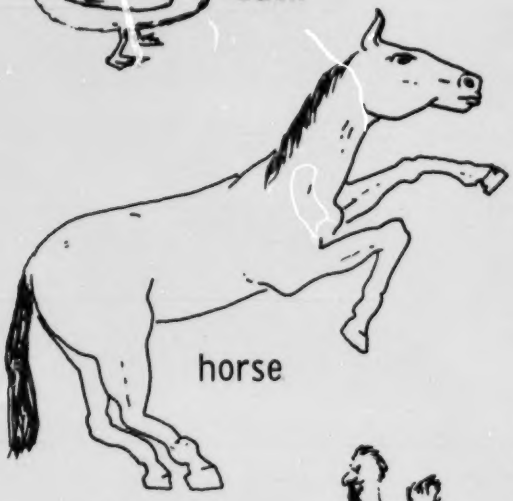
pig



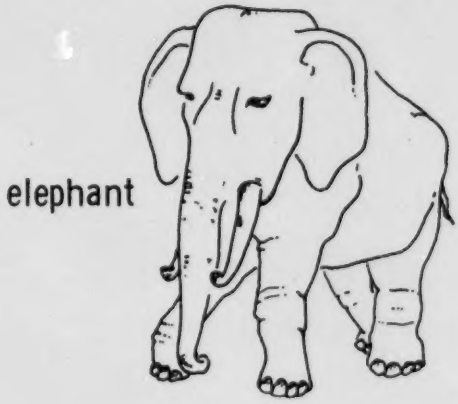
cow

duck

lion



horse



elephant

hen

1. _____ animals have four legs.
2. _____ animals are farm animals.
3. _____ animals are both farm animals and animals with four legs.
4. _____ animals are either farm animals or animals with four legs or both.

Look at the words below. Draw a red ring around every word that has the letter s in it. Draw a blue ring around every word that has the letter e in it.

ask	be	dress	fall	find
get	green	guess	is	know
let	man	mother	red	see
street	that	us	use	you

1. _____ words have the letter s in them.
2. _____ words have the letter e in them.
3. _____ words have both the letter s and the letter e .
4. _____ words have either the letter s or the letter e or both.

Use a spinner which is $\frac{1}{2}$ red and $\frac{1}{2}$ blue.

Spin twice and record under "First spin" and "Second spin".

Repeat 16 times.

Now look at your record of spins. Put tally marks in the right place under Results.

See the Sample.

Total the columns.

	Spins				Results			
	First spin		Second spin		Red & Red	Exactly one Red	No Red	At least one Red
	Red	Blue	Red	Blue				
Sample	/			/		/		/
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
Total								

1. Which result has the greatest number of tallies? _____
2. Are any two results equal? _____
3. If so, which ones? _____
4. Which result has the least number of tallies? _____
5. If you were to guess before you did the activity, which result would you guess would have the greatest number of tallies? _____
6. If you repeated the activity many times, would you expect "No Red" to have less tallies than "Exactly one Red". _____
7. If you repeated the activity, would you expect the results to be exactly the same? _____

Girls, Boys, and Teacher

For this game you need two bags. Put a red and a blue block in each bag.

The girls are one team and the boys are another. Your teacher will be the third team.

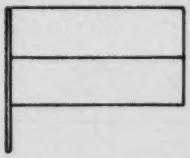
One of the girls starts by drawing a block from each bag. If the two blocks are red, it is a point for the girls. If both are blue, it is a point for the boys. If the two blocks are of different colors, it is a point for your teacher.

Keep a record on this chart.

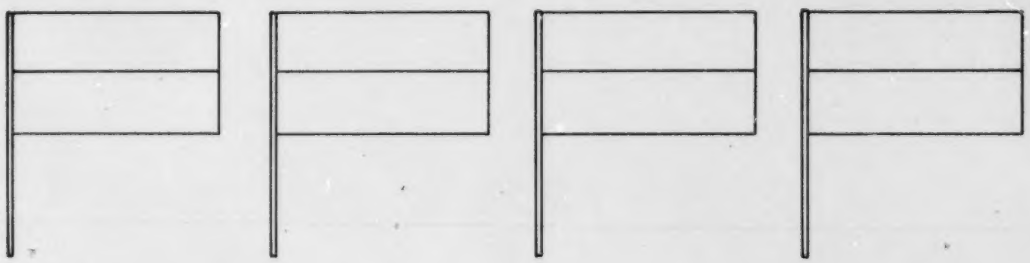
	First Bag	Second Bag	Score for:		
			Girls	Boys	Teacher
Sample	**R**	**B**			1
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
		Totals			

1. Who has the highest score? _____
2. If this game lasted 20 turns, which team do you think would win? _____
3. Does each team have an equal chance to win? _____
4. Draw a circle around each way your teacher can win:

1st bag	2nd bag
R	R
R	B
B	R
B	B

John and Charles want to make a flag like this  for their club. They have one strip of red cloth and one strip of blue cloth. John asks, "How many ways can we put these two strips together to make a flag like this?"

Use your red and blue crayons to show how their flag might look. Here are four boxes to help you.



1. Did you color all four boxes? _____
2. How many ways did you find? _____
3. With just two colors, there are only _____ different ways to color the two parts of the boxes.

Brain Teaser. The boys found a strip of white cloth. Guess how many ways they can make their flag. _____

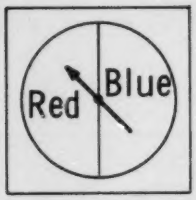
Use your red and blue crayons. See how many different ways you can use just these two colors to color the two parts of the boxes. This time you may use the same color in both parts of a box.

1. How many ways did you find? _____
2. How many boxes are all red? _____
3. How many boxes are all blue? _____
4. How many boxes are part red and part blue? _____
5. How many boxes are at least part blue? _____
6. How many boxes are at least part red? _____
7. How many ways can you color these boxes with two colors? _____

Brain Teaser. If you could use three colors, guess how many ways you can color boxes like these. _____

Spinner and Checker

How many possibilities are there if we use this spinner and then toss a checker?



Let's find out.

First, spin the pointer. Put a tally in the chart to show the result. Then spin or toss the checker and tally the result. Do this 12 times.

The sample shows a result of red on the spinner and a star on the checker.

	Spinner		Checker	
	Red	Blue	♔	☆
Sample	1			1
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				

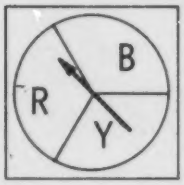
Look at the chart you just made to answer these questions.

1. In the same turn, did you ever have red on the spinner and a crown on the checker? _____
2. Did at least one of the turns give red on the spinner and a star on the checker? _____
3. In the same turn, did you ever get blue on the spinner and a crown on the checker? _____
4. In the same turn, did the spinner ever show blue and the checker show a star? _____
5. Can you think of any possibility which you did not get? _____
6. How many possibilities are there with this spinner? _____
7. How many possibilities are there with a checker? _____
8. How many possibilities are there with this spinner and a checker? _____

We found four possibilities when we used this spinner and then spun a checker. They are: Red, Crown; Red, Star; Blue, Crown; Blue, Star.

Complete this table using R for Red, B for Blue, C for Crown, and S for Star.

		Checker	
		Crown	Star
Spinner	Red	RC	
	Blue		



Now let's find the possibilities with this spinner and a checker.

Complete this table. You may spin the pointer and toss a checker if you need to.

Spinner \ Checker	Crown	Star
Red	RC	
Blue		
Yellow		

1. How many possibilities are there with this spinner? _____
2. How many possibilities are there with the checker? _____
3. How many possibilities are there with this spinner and a checker? _____

4. How many possibilities are there with:
   (a) red on the spinner and a crown on the checker? _____
   (b) red or blue on the spinner and a star on the checker? _____
   (c) yellow on the spinner and a crown or a star on the checker? _____

5. With the spinner of 2 colors and the checker, there are _____ possibilities.

6. With the spinner of 3 colors and the checker, there are _____ possibilities.

Miss Holliday always has one boy and one girl lead the class to lunch. The boys who have not had a turn are Bob, Dan, Tom, and Frank. The only girls who have not had a turn are Mary and Helen.

Miss Holliday writes each name on a card like this:

Bob	Dan	Tom	Frank	Mary	Helen

To find out who will lead the class today, Miss Holliday puts the boys' names in one box and the girls' names in another box. Then she draws one name from each box.

How many different possibilities are there for a boy and a girl to lead the class?

You can complete the table or write the names of the possible leaders here.

	Leaders	
	Girl	Boy
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

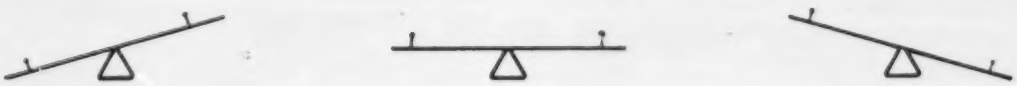
		Boys			
		Bob	Dan	Tom	Frank
Girls	Mary	MB			
	Helen				

1. With the 2-colored spinner and the checker, there were _____ possibilities.
2. With the 3-colored spinner and the checker, there were _____ possibilities.
3. With 4 boys and 2 girls, there are _____ possible pairs of leaders with one boy and one girl.

Betty, Anne, and Sally want to play on a swing that is made for two children. Use B, A, and S for the names of the children. Put these letters on the swings to show the three pairs of children.

From three children we can choose _____ pairs.

Jim, Andy, and Erik want to play on a teeter-totter. Show the different pairs of children (one on each end). Use J, A, and E for the names of the children.



1. How many times does Erik get to play? _____
2. Three children can teeter-totter (two at a time) in _____ ways.

Mary, Tom, Susan, and Billy are playing a game. They want to choose a team with 2 children. Show all the teams they can choose. Use M, T, S, and B for their names.

M and T _____ and _____ and _____

_____ and _____ and _____

_____ and _____

1. How many teams would Tom be on? _____
2. How many teams would Susan be on? _____
3. Each pupil would be on how many teams? _____
4. From 4 children we can choose a team of two in _____ different ways.
5. From 3 children we can choose a team of two in _____ different ways.
6. From 2 children we can choose a team of two in only _____ way.
7. Guess how many teams of two can be chosen from 5 children. _____

In the Brown family, five children -- Mary, Steven, Becky, Linda, and Ricky -- take turns doing dishes. Two children work together each day. Show all the ways they might work. Use M, S, B, L, and R for the names of the children.

M and S	____and____	____and____	____and____
____and____	____and____	____and____	
____and____	____and____		
____and____			

1. Five children can work in pairs in _____ different ways.
2. How many times was Mary listed? _____
3. How many times was Steven listed? _____
4. Each child was listed _____ times.
5. Who was listed with Mary? _____ _____ _____ _____
6. Who was listed with Steven? _____ _____ _____ _____
7. In 10 days how many times does Linda wash dishes? _____
8. How many different children does Linda wash dishes with in 10 days? _____

In Cedar Falls there is a cub pack which has a den of 6 boys -- John, Chuck, Perry, Andy, George, and Herman. They work together on various projects in teams of two. Show all the ways they might make up a team of two. Use J, C, P, A, G, and H for their names.

J and C	C and P	P and A	A and G	G and H
___and___	___and___	___and___	___and___	
___and___	___and___	___and___		
___and___	___and___			
___and___				

1. Each cub is listed how many times? _____

2. Have you organized your work so that it is easy to find results? _____

3. From 2 children we can choose a team of two in only _____ way.
   From 3 children we can choose a team of two in _____ ways.
   From 4 children we can choose a team of two in _____ ways.
   From 5 children we can choose a team of two in _____ ways.
   From 6 children we can choose a team of two in _____ ways.

4. Guess. From 7 children we can choose a team of two in _____ ways.

Betty likes all kinds of animals. Her mother will let her have three pets. However, Betty must choose from a dog, bird, fish, and turtle.

Show all the combinations of three pets that Betty can have. Use the letters d, b, f, and t.

1. _____ _____ _____ 4. _____ _____ _____

2. _____ _____ _____

3. ___ ___ _____ _____

1. Did you find the four different combinations of pets? _____
2. A dog is in _____ of these combinations.
3. A bird is in _____ of these combinations.
4. Do not look at your list of combinations. Do you know how many of these combinations include a fish? _____
5. From 4 pets, Betty can choose _____ combinations of 3.
6. From 4 different crayons, how many combinations of 3 could you choose? _____

Betty's mother thinks that a snail might be a satisfactory pet. She lets Betty choose three pets from a dog, bird, fish, turtle, and snail. Show all the combinations of three pets that Betty can choose from these five pets. Use the letters d, b, f, t, and s.

1. ____ ____ ____
2. ____ ____ ____
3. ____ ____ ____
4. ____ ____ ____
5. ____ ____ ____
6. ____ ____ ____
7. ____ ____ ____
8. ____ ____ ____
9. ____ ____ ____
10. ____ ____ ____

1. Did you write your answers in an organized way? _____
2. From 5 pets, Betty can choose _____ combinations of 3.
3. How many times is a snail in one of the combinations? _____
4. Betty's father puts a penny, nickel, dime, quarter, and half dollar on the table. He asks Betty to make as many different combinations of 3 coins as she can. How many combinations of 3 coins can Betty make from these 5 coins? _____
5. If you could keep just one combination of the coins, which would you choose? _____ _____ _____

David and his family are going on a vacation. He can take four model toys with him. He chooses from a car, plane, boat, train, and soldier.

Show all the combinations of four models that David can take. Use the letters c, p, b, t, and s.

1. _____ _____ _____ _____
2. _____ _____ _____ _____
3. _____ _____ _____ _____
4. _____ _____ _____ _____
5. _____ _____ _____ _____

1. How many combinations did you find? _____
2. With 5 models there are _____ combinations of 4.
3. How many times is a car in one of the combinations? _____
4. David's father lists five states they might visit on their vacation. David can choose the four states he would like to see. How many combinations of 4 states can David choose from the 5 listed by his father? _____

Ann, Betty, Charles, and David choose a team of 2. The possible teams are:

A, B	B, C	C, D
A, C	B, D	
A, D		

Elsie joins the group. Now with 5 children they decide to make teams of 3. One way to find all the possible different teams is to just add Elsie to each of the teams listed above.

A, B, E	B, C, ___	C, D, ___
A, C, ___	B, D, ___	
A, D, ___		

Now use A, B, C, and D to find the teams of 3 which do <u>not</u> include Elsie.

A, ___, C A, B, ___ A, C, D ___, C, D

6 teams have Elsie and 4 do not, so there are _____ teams in all.

5 children can choose _____ different teams of 3 members.

Fred joins the group. They now have Ann, Betty, Charles, David, Elsie, and Fred. The 6 children decide to make up teams of 4. How many different teams of 4 can be formed from 6 children?

We can use the same method as before when Elsie joined the group. Add Fred to each of the "3-child" teams.

A , B , E , F	B , C , E , ___	C , D , E , ___	A , B , C , F
A , C , E , ___	B , D , E , ___		A , B , D , F
A , D , E , ___			A , C , D , ___
			B , C , D , ___

Find the remaining teams, using A, B, C, D, E, which do not include Fred.

A, B, C, ___	A, B, C, ___	A, B, D, E	A, C, D, E	B, C, D, ___

_____ teams have Fred and _____ do not. There are _____ teams in all.

6 children can choose _____ different teams of 4 members.

Alice and Jane are playing "Follow the Leader". Use A and J to show the ways the line might look.

First __A__, then __J__.

First _____, then _____.

Two children can make _____ arrangements.

Alice and Jane let Sally play "Follow the Leader" with them. Use A, J, and S to show how the line might look.

__A__, __J__, __S__

_____, _____, _____

_____, _____, _____

_____, _____, _____

_____, _____, _____

_____, _____, _____

1. How many times was Alice 1st? _____
2. How many times was Alice 2nd? _____ 3rd? _____
3. How many ways can the 3 children line up? _____
4. As arrangements grow larger, it is hard to keep track of the information. Is yours organized? _____

Miss Johnson has three reading groups. She calls them to study in different orders. One day she called Group 1, then Group 2, and last Group 3. Show all the ways she can arrange the order of the groups.

1, 2, 3 ____, ____, ____ ____, ____, ____

____, ____, ____ ____, ____, ____ ____, ____, ____

3 groups can be arranged in _____ ways.

If Miss Johnson had only two reading groups, how many ways could she arrange them? _____

Miss Armstrong likes to vary the order in which she eats her lunch. She always brings a sandwich, some fruit, and a piece of cake. Show the ways she can eat these in different order. Use S, F, and C for sandwich, fruit, and cake.

____, ____, ____ ____, ____, ____ ____, ____, ____

____, ____, ____ ____, ____, ____ ____, ____, ____

If she eats the fruit first, what could she eat second? _____ or _____.

If she eats the fruit first and sandwich second, what might she eat last? _____

Miss Peterson's 3rd grade has 4 favorite games. They often vote to decide which game to play first. Help Miss Peterson by listing the different arrangements in which the games can be played. Use 1, 2, 3, 4 for the names of the games.

1, 2, 3, 4	3, ___, ___, ___
1, 2, 4, ___	___, ___, ___, ___
1, 3, ___, ___	___, ___, ___, ___
1, ___, ___, ___	___, ___, ___, ___
1, 4, ___, ___	___, ___, ___, ___
1, ___, ___, ___	___, ___, ___, ___
2, ___, ___, ___	4, ___, ___, ___
___, ___, ___, ___	___, ___, ___, ___
___, ___, ___, ___	___, ___, ___, ___
___, ___, ___, ___	___, ___, ___, ___
___, ___, ___, ___	___, ___, ___, ___
___, ___, ___, ___	___, ___, ___, ___

How many arrangements are there of the 4 games? _____

Match the Boxes

First, color any one of these boxes red. Then color another green. Now color blue the box that has not yet been colored.

Look at the way your teacher has colored the three boxes on the board.

1. Were all three of your boxes in the same place as the teacher's boxes ? _____
2. Was just one of your boxes in the same place as the teacher's? _____
3. How many children in your class had boxes colored in the same order as the teacher? _____
4. How many children matched only the teacher's first box? _____ Only the second box? _____ Only the third box? _____

38

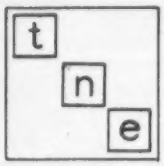
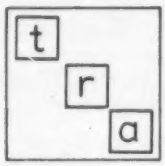
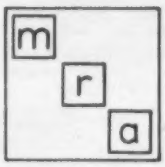
Use your red, blue, and green colors. Show all the possible arrangements of the three boxes.

1.
2.
3.
4.
5.
6.

1. How many times does one of your rows of boxes match your teacher's row? _____
2. How many chances in six are there that one of your rows will match your teacher's row? _____
3. How many times are none of your colors in the same place as your teacher's? _____
4. How many chances are there in six that none of your colors are in the same place as your teacher's? _____
5. How many times do you have just one box match the teacher's boxes? _____
6. How many chances in six are there that just one of your boxes will match the teacher's boxes? _____

A BIRTHDAY PARTY GAME

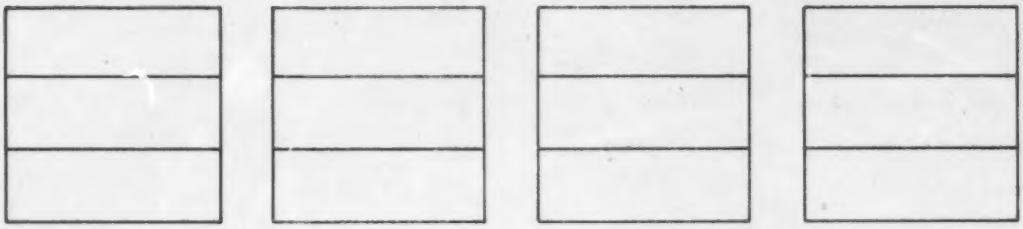
Mrs. Black made a game for Tom's friends to play at a party. She put cards with letters on them in four boxes. Each boy chose a box. Then he drew the letters out of his box, one by one, without looking. Mrs. Black wrote the letters down as the boy drew them. If the letters were in the right order to make a real word, he got a prize. Here are the boxes of letters. Write all the arrangements for the letters in each box under the box.

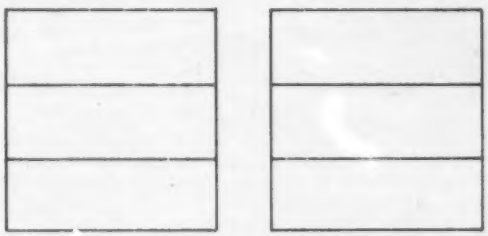
Blue box	Green box	Pink box	Yellow box
			
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

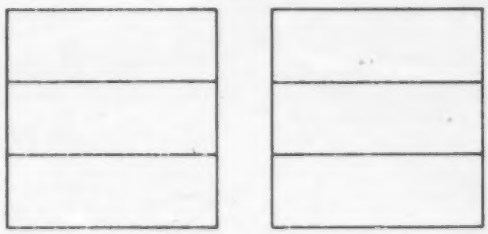
1. Put an X to the right of each arrangement that is a real word.
2. Which boxes would you most want to get? _____ or _____
3. Which box would you least want to get? _____
4. Which box gives you 2 out of 6 chances to make a word? _____
5. In which box is the chance for a word 1 out of 6 ? _____

Use your red and blue crayons to color the three parts of these flags. See how many different ways you can color them.

3 Reds 2 Reds 1 Red No Reds





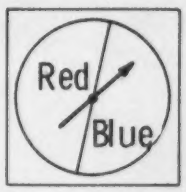


1. How many ways are there? _____ How many flags are all red? _____
2. How many flags have more red than blue? _____
3. How many flags have more blue than red? _____
4. How many flags are all blue? _____
5. How many flags have at least 1 part red? _____
6. How many flags have at least 1 part blue? _____

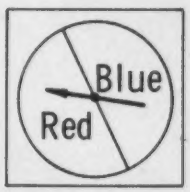
On another page we recorded the results of two spins of a $\frac{1}{2}$ red and $\frac{1}{2}$ blue spinner. We noted that it is possible to get:

Two Reds	One Red	No Reds
Red, Red	Red, Blue	Blue, Blue
	Blue, Red	

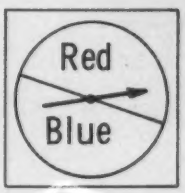
Here are pictures of 3 spinners.



A



B



C

If all three are spun at the same time, list the arrangements of colors we could get.

Three Reds	Two Reds	One Red	No Reds
___, ___, ___	___, ___, ___	___, ___, ___	___, ___, ___
	___, ___, ___	___, ___, ___	
	___, ___, ___	___, ___, ___	

1. How many different arrangements are there? _____
2. How many are all red? _____
3. How many have exactly two red? _____
4. How many have at least two red? _____
5. How many have at least one red? _____
6. How many have no reds? _____

Brain Teaser. If you spin the 3 spinners 16 times, you would expect RRR to happen about _____ times.

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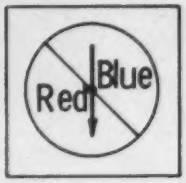
Use this spinner.



The spinner is to be spun in groups of three spins.

Record the results.

1st spin		2nd spin		3rd spin		Three Reds	Exactly Two Reds	Exactly One Red	No Reds
Red	Blue	Red	Blue	Red	Blue				
				Totals					

Use the totals on the table you just completed to answer:

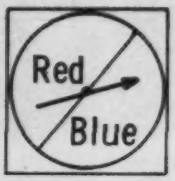
1. How many "Three Reds" are there? _____
2. How many "Exactly Two Reds" ? _____
3. How many "Exactly One Red" ? _____
4. How many "No Reds" ? _____
5. On 24 groups of spins, about how many "No Reds" would you expect? _____
6. Did you get the same number of "Three Reds" as "No Reds" ? _____
7. Are your results exactly the same as the expected results? _____
8. In many groups of spins, would you expect the number of "Three Reds" to be about the same as "No Reds" ? _____

Brain Teaser. In 800 groups of spins:

(a) I would expect "Three Reds" to happen about _____ times.

(b) I would expect "Exactly Two Reds" to be the result about _____ times.

(c) I would expect "Exactly One Red" to be the result about _____ times.



Write in the table to show all the possibilities of two spins on the spinner. Red and blue are equally likely.

		Second spin: Red	Second spin: Blue
First spin	Red	R R	R
First spin	Blue	B	

1. This table shows there are _____ different possibilities when we spin this spinner twice.

2. Complete this list of possibilities:

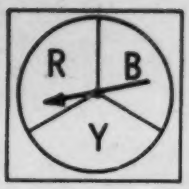
Both Red	Exactly 1 Red	0 Red
R R	R B	_ _
	_ _	

3. The chances of getting red on both spins are _____ in 4.

4. There is _____ chance in _____ of getting blue on both spins.

5. How many chances in 4 are there of getting only one red on two spins? _____

6. How many chances in 4 are there of getting at least one blue on two spins? _____



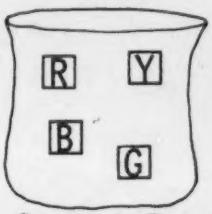
This spinner is spun two times. Use the table to show all the possible results. The three colors are equally likely.

Second spin

First spin	R	Y	B
R			
Y			
B			

1. With two spins there are _____ possible results.
2. The chances are _____ in 9 that both spins will stop on red.
3. The chances of blue on both spins are _____ out of _____.
4. Of the 9 possibilities, there are _____ which have at least one yellow.
5. The chances are _____ in 9 that at least one spin will stop on blue.
6. Look at your table. How many times do you have RY ? _____
   The chances of getting RY are _____ in _____.
7. The chances of getting a YY are
   equal to less than greater than
   getting an RB. (Circle the correct one.)

Each of these bags has a red, a yellow, a blue, and a green block. You draw a block from each bag, both bags at the same time. Then each block is returned to its bag. Use a table to show all the possibilities.



Second Bag

First Bag

	R	Y	B	G
R				
Y				
B				
G				

1. There are _____ possible results.
2. The result R R has _____ chances in _____.
3. Of the 16 possibilities, there are _____ which have only one green. So there are _____ chances in 16 of having only one green block in one of the possibilities.
4. The chances of at least one green are _____ out of _____.
5. A result of a blue block and a green block happens _____ times out of 16.
6. Will a blue block and a yellow block be expected more often than two yellow blocks? _____

This spinner is spun three times. Complete the tables to show all the possible results.

Complete this table first.

First spin \ Second spin	Red	Blue
Red		
Blue		

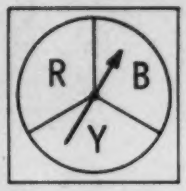
First two spins \ Third spin	Red	Blue
R R		
R B		
B R		
B B		

Complete this list of possibilities.

3 Red	2 Red	1 Red	0 Red
_ _ _	R R _	_ B B	_ _ _
	R _ _	B _ _	
	B _ _	_ B _	

1. The tables and the list show there are _____ possibilities when we spin the spinner three times.
2. How many chances in 8 are there of getting blue on all three spins? _____
3. There are _____ chances in 8 of getting exactly two reds on three spins.
4. There are _____ chances in 8 of getting at least one blue on three spins.
5. Which is more likely, A or B ? Circle the letter of the correct answer.
   A. to get two reds and one blue
   B. to get three blues

Brain Teaser. It is _____ times as likely that the spinner will stop on red exactly twice in 3 spins than on red 3 times in 3 spins.



We found the possibilities when this spinner is spun two times. Our table was:

Second spin

First spin	R	Y	B
R	R R	R Y	R B
Y	Y R	Y Y	Y B
B	B R	B Y	B B

Complete the table below to show all the possibilities of three spins.

Third spin

First and Second spins	R	Y	B
R R	R R R	R R	
R Y			
R B			
Y			
B			

1. When we spin this spinner 2 times, there are _____ possible results.

2. When we spin this spinner 3 times, there are _____ possible results

3. List the possibilities for 3 spins under these headings:

RRR	YYY	BBB	2R	2Y	2B	all different
___	___	___	___	___	___	___
			___	___	___	___
			___	___	___	___
			___	___	___	___
			___	___	___	___
			___	___	___	___

4. How many times does the result have at least 2 reds? _____

5. There are _____ times when the result has exactly 2 reds.

6. There are _____ times when the result has exactly 2 yellows.

7. There are _____ times when the result has exactly 2 blues.

8. There are _____ results which have one red and one yellow and one blue.

9. How many of the possibilities had exactly 1 red? _____

10. How many of the possibilities had exactly 1 yellow? _____

11. Is it twice as likely that a result will have exactly 1 blue as exactly 2 blues? _____

12. Which of these results is more likely?
3 blues 2 yellows and a red 3 reds all different _____

13. On three spins, which of these results are you least likely to get?
2 blues and a yellow 2 reds and a yellow 3 yellows all different
_____

14. How many possibilities are there if we spin this spinner 4 times? _____

Each of these bags has a red, a yellow, a blue, and a green block.

We found the possibilities of drawing a block from each of two bags. They were:

R R	R Y	R B	R G
Y R	Y Y	Y B	Y G
B R	B Y	B B	B G
G R	G Y	G B	G G

How many possibilities are there when we draw a block from each of two of these bags? _____

Now we will think about drawing a block from each of three bags. Complete this table to show all the 3-block arrangements you can make.

First two blocks \ Third block	R	Y	B	G
RR				
RY				
RB				
RG				
YR				
Y_				
Y_				
Y_				
BR				
B_				
B_				
B_				
GR				
G_				
G_				
G_				

1. How many possibilities are there when a block is withdrawn from each of these three bags? _____
2. How many of these possibilities are BBB ? _____
3. What are the chances in 64 of getting GGG ? _____
4. Is it likely that 2 reds and a yellow will be the result more often than 2 yellows and a red? _____
5. How many times can we expect:
   2 reds and 1 blue? _____
   2 blues and 1 yellow? _____
   2 greens and 1 red? _____
   2 yellows and 1 green? _____

Jim likes cake and Jello for dessert. He can have just one dessert each day. On Tuesday, Thursday, Friday, and Sunday of one week his mother let him choose which one he wanted. Find all the possibilities for his dessert on those four days. Use C for cake and J for Jello.

A. Tuesday C or J

B.

Tuesday	Thursday: C	Thursday: J
C		
J		

C.

Tuesday and Thursday	Friday: C	Friday: J
C,C		

D.

Tuesday, Thursday, and Friday	Sunday: C	Sunday: J
C,C,C		

Look at Table B which shows the possibilities for Tuesday and Thursday.

1. In how many ways can he have dessert for these two days? _____
2. Can he have cake on Tuesday and cake on Thursday? _____
3. If he has cake on Tuesday, he can have _____ or _____ on Thursday.
4. Put an X in this box which stands for Jello on Tuesday and Jello on Thursday.

Tuesday	Thursday: C	Thursday: J
C		
J		

Look at Table C which shows the possibilities for Tuesday, Thursday, and Friday.

Tuesday and Thursday \ Friday	C	J
C,C		
C,J		
J,C		
J,J		

5. How many possibilities are there for dessert on these three days? _____

6. There are _____ chances in 8 of having Jello on at least 2 of these days.

7. Put an X in the box which stands for Jello on Tuesday and Friday and cake on Thursday.

8. Put an O in the box which stands for cake on Thursday and Friday and Jello on Tuesday.

Look at Table D which shows the possibilities for all four days.

9. How many possibilities are there for dessert on these four days? _____

10. This is _____ times as many ways as for three days.

11. In how many ways can he have cake twice and Jello twice? _____

12. In how many ways can he have Jello exactly 3 times? _____

13. There are _____ chances out of 16 to have cake exactly 3 times.

14. In how many ways can he have cake at least 1 time? _____

15. In how many ways can he have Jello at least 2 times? _____

16. In how many ways can he have cake more than 3 times? _____